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## ERYSIPHEAE OF RILEY COUNTY, KANSAS.

By LORA L. WALTERS, Manhattan.

Erysipheae, commonly known as "white mildews," or "blights," may be easily recognized by the white dusty or web-like coating on the outside of leaves or stems or other parts of many common plants. This white coating, the mycelium, consists of numerous slender colorless threads, branching and intercrossing, pressed close to the host plant. At short intervals they send out special branches, called haustoria, that penetrate the epidermal cells, serving to attach the fungus to the host, and also to extract nourishment.

Erysiphae are reproduced both asexually by conidia and sexually by sporidia. Chains of conidial cells are formed at the ends of short branches of the mycelium, called fertile hyphae or conidiophores. Under favorable conditions these conidia germinate rapidly, sending out slender tubes and forming new mycelium.

The perithecia containing sporidia are globose, sometimes depressed, bodies seated singly on the mycelium. At first they are colorless, then yellow, becoming dark brown or black when mature, bearing thread-like appendages. These perithecia contain delicate, thin-walled sac-like bodies called asci. These are colorless, more or less oval in shape, usually pedicellate, containing from two to eight sporidia. The sporidia are simple spores, colorless, granular, oblong or oval. The perithecia usually appear late in summer and remain on the fallen leaves over winter. They are not provided with any opening, and the spores escape only by the decaying of the perithecium.

Linneus, in *Species Plantarum*, p. 1186, 1753, describes all powdery mildews as one species of fungi, under the name of *Mucor Erysiphe*. He describes it as follows: "*Mucor albus capitulis, fuscis sessilibus. Habitat in foliis Humuli, Aceris, Lamii, Galeopsidis, Lithospermi.*"

In all descriptions the original has been consulted, where it was accessible, and copied. These descriptions are inclosed in quotation marks and follow the citation. The citations not consulted are inclosed in quotation marks. Where the original description could not be obtained the next oldest is given.

This work has been done in the botanical laboratory of the Kansas State Agricultural College. The list is based upon specimens contained in the herbarium of the college.

SPHAEROTHECA, Lev. Ann. Sci. Nat. 3d S. XV, p. 30 [138] (1851). "Mycelium arachnoideum floccosum effusum plerumque persistens. Conceptacula globosa, sporangio unico vesiculoso, octosporo farcta; sporae ovatae. Appendiculae numerosae floccosae cum mycelio intertextae."

S. Castagnei. Lev. Ann. Sci. Nat. Ser. III, Tome XV, p. 31 [139] (1851). "Bifrons. Mycelio effuso arachnoideo plerumque evanido. Conceptaculis minutis sparsis globosis. Appendiculis numerosis brevibus sursum flexis." Leville gives a large number of different host plants of widely separated orders. Perithecia abundant 80-100 mmm, appendages usually colored throughout, asci elliptical, sporidia usually eight, variable in size. On *Bidens cernua* L., *B. connata* Muhl., *Taraxacum* *Taraxacum* (L.) MacM.

ERYSIPHE Hedw. in DC. Flore Franc. II, p. 272 (1805); Lev. (Emend.) Ann. Sci. Nat. 3d S. XV, p. 53 [161] (1851). The following is the original de-

scription from DC. as cited above: "Les erysiphes ont un receptacle charm qui renferme plusieurs pericarpes ovoïdes, aigus, dont chacun contient deux graines; ce receptacle est entoure d'une pulpe blanchatre qui se prolonge en plusieurs rayons articules, simples ou rameux." "Perithecium containing several asci, appendages simple threads similar to and frequently interwoven with the mycelium." (Ellis & Everhart.)

*E. communis* (Wallr.) Link Spec. Pl. 105 (1824) as *Erysibe*. "E. hyphasmate demum effuso, floccis, arachnoides, sporangiis sphaericis sparis numerosissimis tandem nigro-fuscis capillitio albo adfixis. Alphito morpha communis, Wallr. Verhandl. Naturf. Frde. 1, p. 31. Habitat in variis Europae plantis, Diagn. Flocci albidii aut cinerei tenerrimi initio hyphasmata subrotunda formantes tum effusa. Sporangia primum alba tum flava, tandem nigro-fusca. Capillitii flocci simplices albi hyphasmati affixi." Asci 4-8 or more. Sporidia usually 4-8. On *Scutellaria lateriflora*, L. *Astragalus carolinianus* L. *Falcata comosa* (L.) Kuntze.

*E. cichoracearum* DC. Flore Franc. II, p. 274 (1805). "J'ai trouve cette espece a Bagneux, a la fin d'un ete eres-sec; elle attaque les deux surfaces des feuilles de la scorzonere d'Espagne, et du salsifx a feuilles de poireau; ses tubercules sont noirs, epars globuleux, un peu deprimes; de leur base partent des filamens blancs, rayonnans, nombreux, articules et souvent rameux on anastomoses; ces filamens prennent beaucoup d'accroissement avant la naissance des tubercules, et couvrent quelquefois la feuille entiere d'un fin reseau blanc, avant de porter aucun fruit; a la fin de leur vie, ceux qui avoisinent les tubercules deviennent roussatres." Perithecia 100-160 mmm. On *Helianthus tuberosus* L., *Carduus altissimus* L., *Dysodia papposa* (Vent.) Hitchc., *Ambrosia trifida* L., *Parietaria pennsylvanica* Muhl., *Verbena stricta* Vent., *Solidago missouriensis* Nutt.

*E. graminis* DC. Flore Franc. VI, p. 106 (1815). "J'ai trouve cette belle espece d'erysipe sur les feuilles du froment, mais je ne lui en ai pas donne le nom; parce que je crois l'avoir retrouvee sur d'autres especes de graminis a feuilles larges et planes; elle croit sur les deux surfaces, mais principalement sur la superieure; ses pustules sont petites, d'abord rousses, puis noiratres; les filets qui partent de leur base sont nombreux, longs, entre croises, et tellement abodans, qu'ils forment des touffes oblongues, d'un duvet cotonneux, blanc ou roussatre, epais, et dans lequel les tubercules sont plonges de maniere a imiter les loges de certaines spheries." Perithecia 150-200 mmm. On *Poa pratensis* L., *Hordeum pusillum* Nutt, *Triticum vulgare* L.

*UNCINULA* Lev. Ann. Sci. Nat. Ser. III, Tome XV, 43 [151] (1851). "Mycelium epi-vel hypophyllum, floccosum, sub membranaceum, evanidum vel persistens. Conceptacula globosa sporangiis 8-16 subpyriformibus, 2-4 sporis ovatis repleta. Appendiculate rigidae, simplices bifidae vel raro dichotomae apice uncinatae radiato-patentes demum sursum flexae."

*U. neceator* (Schw.) Burrill in Ellis & Everhart N. A. Pyren. 15 (1892) *Erysiphe necator* Schw. Syn. N. A. Fung. No. 2495 in Trans. Am. Phil. Soc. N. S. 4: 270 (1834). "Multo rarius in uvis Vitis labruscae varietatibus cultis in vineis nostris. E. Hyphasma, tenuissimum albidum, floccis valde tenuibus orbiculatum, on constringens. Sporangiolis minutissimis—raris fusco—nigris, globosis. Ubi omnino evoluta, etiam haec species destruit uvas." Perithecia 85-120 mmm. Appendages ( $\frac{1}{2}$ -3) x diameter of perithecia colored one-half of length, frequently septate, tips spirally coiled. Asci 4-6. Very short pedicillate; sporidia 218, long, filling the ascus. On *Parthenocissus quinquefolia* (L.) Planch.

*U. flexuosa* Pk., Trans. Albany Inst. VII, p. 215 (1873). "Mycelium thin, web-like, evanescent; conceptacles minute, .0035 inch in diameter; appendages 15-25, about as long as the diameter of the conceptacle, the apical half wavy flexuous and sometimes slightly thickened; sporangia 8-10, ovate or elliptical; spores 8, elliptical, .0007-.0008 inch long. Figs. 10-12. Lower surface of horse-chestnut leaves. Buffalo. September. G. W. Clinton. The flexuous appendages are characteristic of this species. They sometimes appear as if twisted like the blade of a screw auger." The above description was kindly communicated by Professor Peck. The number of spores for this species are described as 8-10, but all specimens examined showed only six. On *Aesculus arguta* Buckl.

*U. macrospora* Pk. Trans. Albany Inst. VII, p. 215—25th Rep. N. Y. State Mus. p. 96 (1873). "Mycelium effused, persistent, conceptacles subglobose; appendages numerous, 30 or more, about equal in length to the diameter of the conceptacle; sporangia 8 to 12; spores two, very large, elliptical, .0012 to .0015 inch long. Leaves of elm trees." Tips of appendages sometimes septate and coiled. On *Ulmus americana* L.

*U. parvula* C. & P. Erysiphe of the U. S. Jour. Bot. X, p. 170 (1872). "This is very distinct from *Uncinula polychaeta*, B. & C., which is found also on *Celtis*. Not only is the mycelium thinner and more evanescent, but the conceptacles are not half the diameter of those in that species, and the appendages are shorter and far less numerous. Hypophyllous, mycelium effused, delicate, evanescent; conceptacles scattered, globose, minute; appendages simple, numerous, scarcely as long as the diameter of the conceptacles; sporangia elliptical, rostrate; sporidia 6. On leaves of *Celtis occidentalis* L. Pough-keepsie, N. Y. (C. H. P. n. 189)." On *Celtis occidentalis* L.

*U. salicis* (DC.) Winter, Die Pilze, II, p. 40 (1887). Erysiphe *salicis*, DC. Flore Franc. II, p. 273 (1805). "Cette plante n'est peut-etre qu'une variete de l'erysiphe du frene, a laquelle elle ressemble absolument a l'oeil nu; ses tubercules passent de meme du jaun pale a l'orange, au brun et au noir; de la base du tubercule partent plusieurs fils blancs simples qui s'etaient sur la feuille, s'y entre-croisent avec ceux des autres tubercules, et y forment la croute blanche dont la surface de la feuille est recouverte. Cette espece croit sur les feuilles du saule-daphne." Perithecia 120-160 mmm. Sporidia 4 or 5, usually 20-25 mmm long. On *Salix amygdaloides* Anders., *Populus monilifera* Ait.

*PHYLLACTINIA* Lev. Ann. Sci. Nat. Ser. III, Tome XV, 36 [144] (1851). "Mycelium amphigenum; conceptacula hemisphaerica demum depressa receptaculo membranaceo-granuloso persistente vel evanido insidentia, sporangia 8 et ultra in pedicellum protractis 2 vel 4 sporis farcta; sporae ovatae. Appendiculae 8-16 restae, rigidae, aciculatae demum retroflexae."

*P. corylea* (Pers.) P. suffulta Sacc. Mich. II, 50 (1882). Erysiphe *coryli* DC. Fl. Fr. II, p. 272 (1805). *Sclerotium suffultum* Reb. Fl. Neom. 360 (1804). *Sclerotium erysiphe B corylea* Pers. Syn. 124 (1801). Decandolle's description (l. c.) evidently refers to *Phyllactinia*. Pers. name is quoted as a synonym and from the description given below is evidently the same, in which his variety name would have precedence over the name of Rebertsch. "*Sclerotium erysiphe*: Epiphyllum, granulis aggregatis fusco-nigris, tomento albo insidentibus. Obs. myc. 1, p. 13. *Mucor erysiphe*, albus capitillis, fuscis sessilibus. Linn. Syst. Veg. 15, p. 1020.

*B Corylea*: tomentum tenuissimum fungillis in disco impresso subvillosis. Hab. autumnno in variarum herbarum foliis, *B* in aversa, folii *Coryli* avella-

nae parte crescit." If the specific name used by Linnaeus (*Mucor erysiphe*) be taken up, it should probably be applied to the mildew of the hop, as that plant is the first host mentioned under that species (L. Spec. Pl. 1186 (1753).

*PODOSPHAERA* Kunze Mycol. Hefte II, p. 111 (1823). "Perithecium subglobosum; processibus radiculiformibus horizontalibus excentricis, apice in laminam dilatato radicantibus. Ascus solitarius, thecis ovalibus sporidiis octo repletus."

*P. oxycanthae* (DC.) "D'By. Morph. und Phys. der Pilze III, p. 48." *Erysiphe oxycanthae* DC. Flore Franc. VI, p. 106. "On trouve cette erysiphe sur les deux surfaces des feuilles de l'aubepine: elle ressemble a celle de l'ancolie par sa maniere de croître, c'est-a-dire, que ses tubercules sont noirs, epars, tres-ecartes, et ne forment pas, par leur entre croisement, une croute visible; la seule circonstance qui puisse faire distinguer cette espece, est l'extreme brievete des filamens blancs qui sortent de ses tubercules. M. Cauvin me l'a envoyee des environs d'Angers, et M. Chaillot, de Neufchatel. Je l'ai trouvee en Bretagne. M. Bosc me l'a fait observer en grande abondance sur les plants d'aubepine des pepinieres de Versailles; il observe que cette parasite retarde sensiblement la croissance." Amphigenous, mycelium scant or abundant, persistent. Perithecia 65-110 mmm, dark, opaque, appendages sometimes septate, 1-4 times, diameter of the perithecium, 3-5 times dichotomous, branches short, tips recurved, ascus broadly elliptical or orbicular, sporidia usually 8. On cult. plums, leaves of cult. cherry.

*MICROSPHAERA* Lev. Ann. Sci. Nat. Ser. III, Tome XV, p. 381 (1851). This is under list of corrections to the body of the work (pp. 109-179). He substitutes *Microsphaera* for *Colocladia*, hence all the *Colocladiae* become *Microsphaeriae* *Colocladia*, Lev. l. c. 46 [154] (1851). "Mycelium arachnoideum subcontextum evanidum vel persistens conceptacula sporangiis 4-8, ovatis, rostratis, 4-8 sporis repleta. Appendiculae rectae dichotomae, ramulis apice turgidis vel filiformibus."

*M. grossularia* (Wallr.) Lev. Ann. Sci. Nat. Ser. III, T. XV, p. 160 (1851). "Alphitomorpha penicillata var. *Grossulariae*, Wallr. Verh. Naturf. Freunde I, p. 40." The following is from Lev. l. c.: "Bifrons. Mycelio arachnoideo fugaci vel persistente. Conceptaculis sparsis vel gregariis globosis minutis Sporangiis 4-8 ovato-rostratis 4-5 sporis. Appendiculae 10-15 vage dichotomis, ramulis ultimis bidentatis." On *Sambucus Canadensis* L.

*M. symphoricarpi*, Howe Bull. Torr. Bot. Club, V, p. 3. "Mycelium effused, subpersistent, conceptacles scattered or crowded; appendages 8-16, 2-4 times the length of the diameter of the conceptacles, 3-5 times dichotomous, ramuli divaricate, tips variable, often truncate, never curved, sporangia 4-6 with 3-5 spores. Leaves of *Symphoricarpus*. Nov." On *Symphoricarpus symphoricarpus* (L.) MacM.

*M. euphorbiae* (Peck) B & C. Grev. IV, p. 160 (1875). 26th Rep. N. Y. State Mus., p. 80. "Mycelium thin; conceptacles small, .0035 in. in diameter; appendages few, long, flexuous, colored; sporangia broadly ovate, 3-4; spores 3-4, large, .001 x .00065 in." Long tips often trifid or 4-6 x dichotomous, asci pedicellate, sporidia 4-6. On *Euphorbia corollata* L., *E. marginata* Pursh.

*M. alni* (Lam. and DC.) Winter Die Pilze II, p. 38 (1892). *Erysiphe alni* Lam. & DC. Syn. Pl. Gall. 57 (1806). "Hypophylla, filamentis plurimis expansis longissimis liberis—*Sclerotium erysiphe alnea*. Schl. cerat. exs. n. 68. In *Alno incana*. Perithecia 80-100 mmm, abundant, appendages 1-2 times diameter of perithecia, 3-4 times dichotomous branched, tips strongly recurved. Asci orbicular, sporidia usually eight, variable. On *Platanus occidentalis* L.

*M. quercina* (Schw.) Burrill, Bull. Ill. State Lab. Nat. Hist. II, p. 424. *Erysiphe quercinum* Schw. Syn. N. Am. No. 2492 in Trans. Am. Phil. Soc. N. S. 4: 270 (1834). "Hyphasma occupans fere totum folium expansum candidans, tenuissimum, floccis vix distinctis sporangiolis raris minutissimis sparsis nigris. Praesertim loco distinguenda species." Perithecia 90-100 mmm. Appendages 1-4 times diameter of perithecium, hyaline, much interwoven with mycelium, 4-6 times dichotomous, branches short, tips recurved, sporidia variable 3-8. On *Quercus velutina* Lam., *Q. macrocarpa* Michx., *Q. Muhlenbergii* Engelm.

#### DESCRIPTION OF PLATES.

Unless otherwise indicated all magnifications are as follows: Perithecia, x 62; asci, x 225; sporidia, x 500; tips of appendages, x 500.

*Sphaerotheca castagnei*, Fig. 2.

*Erysiphe communis*, Fig. 9.

*Erysiphe cichoracearum*, Fig. 10.

*Erysiphe graminis*, Fig. 11.

*Uncinula necator*, Fig. 4. Sporidia and tips, x 225.

*Uncinula flexuosa*, Fig. 5.

*Uncinula macrospora*, Fig. 6.

*Uncinula parvula*, Fig. 8.

*Uncinula salicio*, Fig. 7.

*Phyllactinia suffulta*, Fig. 3. Tips, x 225.

*Podosphaera oxycanthae*, Fig. 1. Tips, x 225.

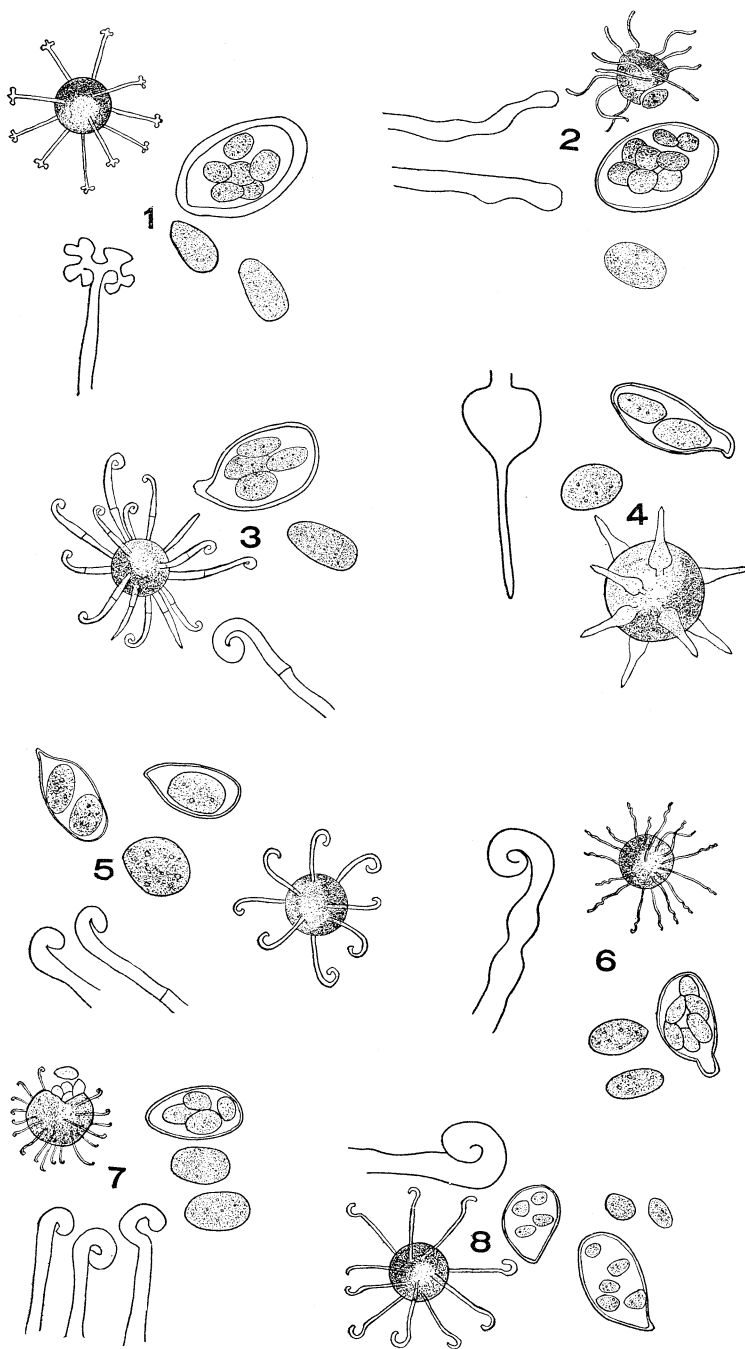
*Microsphaera grossulariae*, Fig. 15. Tips, x 225.

*Microsphaera symphoricarpi*, Fig. 14. Tips, x 225.

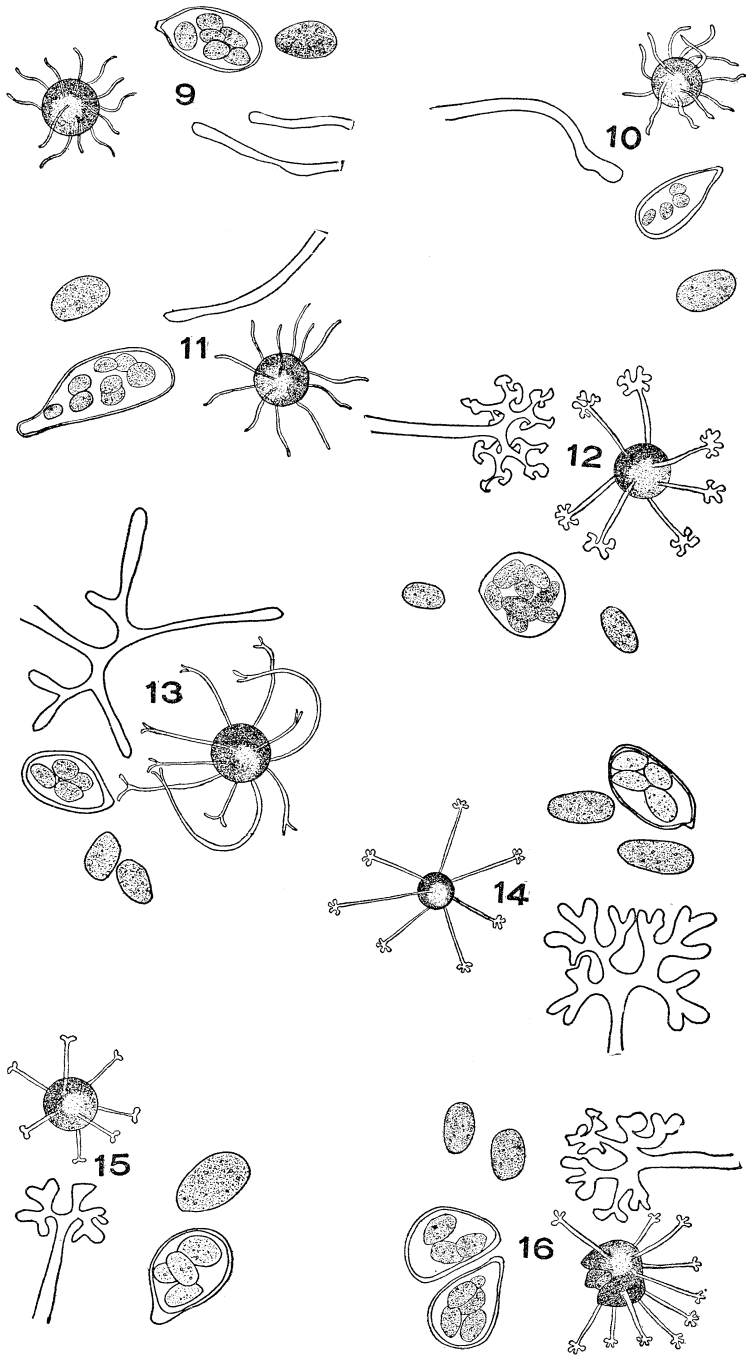
*Microsphaera euphorbiae*, Fig. 13. Tips, x 225.

*Microsphaera alni*, Fig. 12. Sporidia and tips, x 225.

*Microsphaera quercina*, Fig. 16. Tips, x 225.



ERYSIPHEAE OF KANSAS. (Drawn by Author.)



ERYSIPHEAE OF KANSAS. (Drawn by Author.)



## CORRIGENDA.

(Errata are the editor's especial abhorrence.)

The meeting at Manhattan, recorded on page 87, was held December 27, 1894.

The name Lora L. Walters, occurring on pages 88, 89, 200, 366, and 370, should be Lora L. Waters, wherever it occurs.

The name Z. S. Sharp, on page 88, should be S. Z. Sharp.

The name T. D. Hewitt, page 367, should be J. D. Hewitt.

The name T. R. Mead, on page 368, should be J. R. Mead.

The name Henride Sausure, page 369, should be Henri de Saussure.

The name Dr. Jacob Schenck, page 369, should be Dr. Jacob Schneck.

The name Alva T. Smith, page 369, should be Alva J. Smith.

The name T. D. Walters, page 370, should be J. D. Walters.

Other errors are obvious enough, and may be corrected or overlooked by the courteous reader.